

Make the most of physical tests for anterior cruciate injuries

Bernard R. Bach Jr, MD; J. Calvin Johnson, MD

As the ranks of adults taking part in recreational sports have swelled, anterior cruciate ligament (ACL) injuries have grown more common. Back in the 1960s and 1970s these injuries were difficult to diagnose. Fortunately, many advances have been made in this area in the past decade.

In fact, the apparent increase in ACL injuries may partly reflect our improved diagnostic ability.

Noteworthy advances have spanned the whole spectrum of diagnostic techniques. In the physical examination, the development and refinement of the Lachman and pivot shift tests have been the key advances. This article describes how to get the maximum information from these and other physical tests. A second article in the next issue will discuss how to use recent advances in imaging, arthrometry, gait analysis, and arthroscopy.

History

About 40% of patients with ACL injuries report having heard a "pop" or felt a tearing sensation at the time of injury. The patient usually is unable to continue sports participation; if he or she tries to do so, the knee may collapse.

An apparent increase in anterior cruciate ligament injuries in recent years has been paralleled by improvements in diagnostic techniques. On the physical exam side, the chief advances have been the development and refinement of the Lachman, pivot shift, and other tests. Used correctly, these tests are important diagnostic tools.

The development of a rapid knee effusion, usually within three hours of injury, is highly suggestive of an ACL injury. A hemarthrosis also may be noted with intra-articular fractures, patellar dislocation, and peripheral meniscal tears. In general, however, the hemarthrosis is less tense in a peripheral meniscal or a posterior cruciate ligament (PCL) injury than in an ACL injury. With intra-articular fractures, fat globules will be found on aspiration of the hemarthrosis.

Certain sports are more likely than others to cause ACL injuries; we have found that skiing, basketball, football,

volleyball, and rugby are involved most often. It is important to determine the mechanism of injury, which may suggest which ligaments have been injured (see July/August 1990, pages 5-8). In ski injuries, one should ask not only about the injury mechanism, but also about

the snow conditions, experience level, binding types, and whether the patient was taken off the slopes on a sled or skied down.

In football injuries, one should note whether the injury occurred on artificial or natural turf and whether it occurred in a contact or noncontact situation. It is surprising how often the patient describes a noncontact, deceleration, direction-change mechanism. Valgus, varus, and hyperextension contact injuries do occur, but the valgus mechanism (causing the "unhappy triad" of damage to the medial collateral ligament, ACL, and medial meniscus) has been seen less often in football since some rules were changed in the early 1970s.

In *chronic* ACL insufficiency, patients characteristically describe episodes of "giving way." This instability is often described as a separation of the femur upon the tibia (the "two fist" sign, figure 1).¹ The physi-

continued

cian must try to distinguish this instability from that associated with quadriceps weakness, patellar instability, or meniscal pathology. The possibility of ACL-related meniscal pathology must be kept in mind. Associated meniscal tears may occur in 30% to 50% of acute ACL injuries and in 50% to 75% of cases of chronic ACL insufficiency.

It is surprising how often patients will relate a history characteristic of ACL injury, including an emergency room visit and negative radiographs, and say they were given no specific diagnosis because there was no fracture. Any sports-related knee injury, whether contact or noncontact, that was accompanied by a "pop" and leads to an effusion within several hours should be considered an ACL injury until proven otherwise.

The Lachman test

In the 1960s and early 1970s, the anterior drawer test (figure 2) was thought to be the most sensitive physical examination test for knee injuries. However, anterior translation of the knee at 90° may be reduced in a patient who has a meniscal tear, hamstring spasm, effusion, or apprehension.^{2,5} In addition, selective cutting studies and arthrometric tests have indicated that there is less anterior-posterior displacement of the knee at 90° than at 30°. ^{6,9}

In 1976, Torg¹⁰ popularized the Lachman test, which he attributed to his mentor, John Lachman. In this test, an anterior pressure is applied to the back of the lower leg with the knee flexed between 25° and 30° (figure 3). Several studies that compared physical examination findings have demonstrated that the Lachman test is much more sensitive than the anterior drawer test in the clinical diagnosis of ACL insufficiency.^{3,5} We have noted similar results in an unpublished study com-

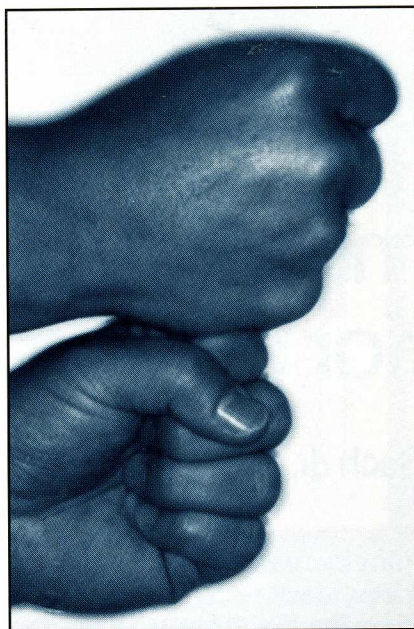


Figure 1. The 'two fist' sign is often made by patients in describing the symptoms of ACL insufficiency. Patients describe a sensation that the knee is 'shifting' or the bones are 'coming apart.'

paring three physical tests and a KT-1000 arthrometric evaluation.

Noyes and coworkers, who popularized the concept of primary and secondary restraints about the knee, emphasized that a little laxity represents a lot of injury.^{7,8} For this reason, it is essential to compare the injured knee with the uninjured knee and to measure the difference in translation. Laxity is graded by the magnitude of this difference: grade 1, 1 to 5 mm; grade 2, 6 to 10 mm; grade 3, 11 to 15 mm; and grade 4, greater than 15 mm. Variations in the displacements of normal knees occur, and patients with general ligamentous laxity may have normal anterior displacements approaching 10 mm. At the same time, patients who are "tight jointed" and have torn the ACL may have a displacement of less than 10 mm. Thus it is important to compare the opposite extremity.

Displacement of the tibia on the

Lachman test will result in the sensation of a firm end point if the knee is normal. In an ACL-deficient knee, the end point is generally absent or "soft." In some patients who have complete ACL insufficiency with a pivot shift phenomenon, the Lachman test may yield a "pseudo" end point, ie, the sensation of an end point but with increased displacement. This is thought to reflect intact secondary restraints and the presence of a vertical strut formed by the adhesion of the previously torn ACL to the adjacent PCL tissues.¹¹ If a patient has a partial ACL injury, an end point may be present although the Lachman test results will be asymmetric.

When performing the Lachman and anterior drawer tests, one should note the position of tibial rotation, which may vary slightly. With the knee flexed 90° and the tibia externally rotated, increased anterior translation suggests injury to the posteromedial corner of the knee, in addition to an ACL injury.

The Lachman test is normally done with the patient supine, but it can also be performed with the patient prone. This is helpful if the patient is heavy and has large legs, which may preclude accurate assessment of the test. In the prone position, the thigh is stabilized by the examining table and the tibia can be passively subluxated anteriorly with ease. When the supine position is used for the test, some patients may be more relaxed with the leg dangling off the side of the table and the foot cradled and supported by the examiner's thighs, rather than with the leg raised.

Finally, when the ACL is deficient and the quadriceps muscles are contracted, anterior tibial displacement is abnormal. Such a "quadriceps-activated" demonstration of ACL insufficiency may be seen in many patients. At about 25° of knee flexion the pa-

